Review [Review of: A. Gruebler (2000) Technology and global change]

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of the nineteenth century . . . Austrian cycle theory was itself one of the newest and demonstrably most original bodies of doctrine developed in the inter-war years," even though it was later forgotten to an extent that the Swedish theories were not (pp. 13–14).

The British economists who owed their first allegiance to Alfred Marshall rather than to Wicksell take up the next and longest part of the book. This coherent, wide-ranging, and illuminating account runs from Marshall's closest followers in monetary economics and cycle theory in the 1920s—A. C. Pigou and Frederick Lavington—to D. H. Robertson, to the J. M. Keynes of *A Tract on Monetary Reform* (London: Macmillan, 1923) and *A Treatise on Money* (London: Macmillan, 1930), to R. G. Hawtrey, through to Richard Kahn's discovery of the employment multiplier. While these economists concentrated on explaining monetary and cyclical phenomena, there was a parallel debate in Britain about the causes of unemployment. Laidler covers the contributions of William Beveridge, Pigou, and others to that debate. Pigou, in particular, comes in for fairer treatment than he has received for decades.

The chapters on the work of American economists are less tightly argued, reflecting the disparate nature of their ideas, but it is appropriate to point out in an economic history journal that Laidler is very good at bringing out the very different economic and historical experiences that made American and European economists' concerns so different over much of the interwar period.

The chapter summarizing Keynes's *General Theory of Employment, Interest and Money* (London: Macmillan, 1936) is masterly, a fact which is hardly a surprise given what has preceded it. It also amply demonstrates the good sense of Laidler's decision not to let his own findings be obscured by attacks on the misconceptions abounding in the secondary literature. The significant contributions of that literature are recognized, however, in footnotes throughout the book. There is a fascinating review of the major reviews of the *General Theory* before the final substantive chapter on the IS-LM model and the way its creators, especially Hicks, used it.

Any review worth its salt must include some criticisms. I offer two. The "Selective Synthesis" which concludes the book comes as something of an anticlimax, the major hypotheses of the book having been more provocatively stated back in chapter 1. And on the last page of the penultimate chapter Laidler reads more than I think he should into a remark that Lerner made in 1936 ("But we must not forget that it is not so very long ago that we had Professor Robbins and Mr. Keynes on the wireless respectively advising the world to save more and to spend more") when he argues that "the fact that Robbins was the only 'pundit of economic science' actually named there was surely significant" (p. 320). But Robbins and Keynes had recently both broadcast in a well-publicized series which had recently been published (*The Burden of Plenty?* edited by Graham Hutton. London: Allen & Unwin, 1935). Neither criticism can detract from the excellence of this book. No one interested in the economics or the economic history of the interwar period should fail to read it.

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Technology and Global Change. By Arnulf Grübler. Cambridge: Cambridge University Press, 1998. Pp. x, 452. $49.95.

Those who distrust grandiose titles can be reassured at once: this book delivers the goods. The author sticks to his word. The basic issue with which he deals is the so-called technology-environment paradox: the paradox that technology is both a source of, and a

remedy for, global environmental change. "Global change" is defined here as "transformation processes that operate at a truly planetary scale," such as global warming, and "processes that operate at smaller spatial scales but that are so ubiquitous and pervasive as to assume global importance," such as urbanization. Grübler—a Research Scholar at the Institute for Applied Systems Research in Laxenburg, Austria—wants to determine, first, which aspect of technology (as source of or as remedy for environmental change) is nowadays predominant, and second, how to ensure that the latter prevails. Thus the author intends to provide a sound historical base for future policy concerning technology and the environment.

As Grübler's work aims to serve both specialist and nonspecialist readers, it tends to be exhaustive rather than succinct. Part 1, an overview of concepts, definitions, models, and general patterns of technological change, runs to over 100 pages; this is longer than is strictly necessary for finding an answer to the problem at hand. The author clearly thought it more important to pack all current insights on the historiography of technology into a single toolbox rather than merely to select the instruments needed to perform a surgical strike. Part 2 is exhaustive as well, but in a different way. It presents a wealth of empirical data on long-term changes in agriculture, industry, and services in various parts of the world between about 1800 and the present, the role of technology therein, and the consequences for the global environment. For agriculture and industry, Grübler uses the evolution of output and productivity as yardsticks of change; for the service sector he instead concentrates on phenomena on the consumption side, namely shifts in expenditure patterns and time budgets. Environmental impact is measured by data on such indicators as erosion, resource depletion, carbon emissions, and efficiency of energy use. After a review of the historical evidence in the light of the technology-environment paradox, the book concludes in Part 3 with a survey of policy implications and of the major issues awaiting further research, plus an outline for building a formal "integrated model of technological change" that tallies with the interpretation of the historical data presented in the foregoing chapters. The author does not pretend that he already has a neat model on hand.

Grübler's main achievement, aside from compiling a useful array of data on economic, technological and environmental change, is a careful, well-argued assessment of the environmental impact of technological innovations. This leads to interesting, though rarely exciting, observations on individual technologies and on technological development at large. Regarding the former, for instance, Grübler remarks that recent research has revealed that paper recycling does not always have environmental advantages over other techniques of waste disposal, and under certain conditions can be even more harmful than using virgin wood fibers (pp. 245–46). Regarding technological development at large, the author on the one hand points to recurrent, ascertainable features (such as the S-curve) in the life-cycles of innovations or path-dependent, "locked-in" trajectories of change; but on the other hand he very sensibly draws attention to the fact that the rate and direction of change cannot be accurately predicted because technological creativity is essentially marked by diversity and uncertainty, and because the diffusion of innovations is ultimately determined by social choice. Still, the evidence on the productivity and efficiency gains already attained via "learning effects" and R&D lead the author to infer that technology can provide remedies for at least *some* of the environmental stresses it has brought in its wake. Given the state of knowledge on the subject as reported by Grübler, this is for the time being probably the most far-reaching conclusion that can be reached.

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